Rural-Urban Differences in Nursing Home Access, Quality and Cost

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Abstract

Rural-urban differences in the supply of nursing home services are hypothesized to be jointly affected by competitive and regulatory forces, government policies, and the cost structure. Study findings indicate that rural services are slightly less accessible and lower in quality. A translog cost share function reveals no difference in the operating cost structure of rural and urban homes. Cost shares for nursing care are directly related to the degree of skilled nursing provided by homes. Significant scale economies were not detected for any of the major operating costs.

Key Words: rural health care, nursing homes, cost structure.

As we move into the twenty-first century and encounter accelerated growth of the aged population, nursing home care likely will emerge as even more of a prevalent and costly segment of U.S. health care programs. This likelihood has been well documented in the literature on public health. Raffel and Raffel observe that by 2010, one year before the "boomers" first begin reaching age 65, over 14 percent of our total population already will be over 65. Ray, et al., project that the number of the very old (those 85 and older) is likely to grow to at least 6.9 million by year 2012, up sharply from 2.5 million in 1982. Indeed, even as early as the 1962-83 period, nursing home expenditures increased about 20 percent per year, and their public share jumped from 28 to 55 percent--faster than any other component of U.S. health care costs (Holahan and Cohen). By the mid 1980s, this rate slowed to single digits, but resumed its double-digit pace by 1989, advancing again to over 12 percent in the 1990s (Letsch, et al.). Even larger shares are likely to be borne by the public, perhaps even in the next few years.

Government financing of nursing home services and other programs for long-term care reflect a social consensus that, to the extent economically feasible, older people in the United States should have reasonable access to a basic set of quality, long-term health care services. Even so, if future funding is to be significantly provided through public programs, the accessibility and quality of nursing home care will likely come under much more government scrutiny and control. Aggregate aspects of long-term care financing reforms recently have been carefully analyzed and compared for the aged populace (McCall, et al. in 1991, Scanlon in 1992). But any special study of rural areas, or any comparisons of rural-urban characteristics, has yet to be made. This is especially true from a supply perspective. The accessibility of services from nursing homes in rural versus urban areas has not previously been studied.[1]

In this paper, we examine the relationship between the improvement of accessibility to nursing homes in rural areas of South Carolina and their

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cost to society.[2] Effects of competitive and regulatory forces are examined by comparing descriptive features of provider accessibility and provider-based quality indexes. The comparative cost structure of rural and urban homes is analyzed by a multi-product translog cost function. Estimates of cost structure functional parameters are derived to determine if input prices and/or underlying production functions differ between rural and urban homes. The policy implication of this study is that it may be possible to improve accessibility of rural nursing care without a significant increase in costs. Besides, developing rural nursing homes may also improve economies of rural areas.

Conceptual Setting

Health services provided by a nursing home are subject to the home's cost structure and to a contemporaneous set of policy guidelines and competitive and regulatory constraints. This health services environment is continually changing and may differ in its specific features, between homes located in rural and urban areas.

Competition in the nursing home industry is tied to the relative mix of public and private-pay patients. In 1991 in South Carolina, private-pay patient days accounted for approximately 30 percent of total patient days; the comparable U.S. average was 43 percent (Letsch, et al., p. 28). Since the per-diem rate for private-pay patients is not regulated by the state or federal governments, private patients will pay higher rates to obtain more and/or higher quality services. A separate private-pay demand function has yet to be quantified (Ullman). But regulatory "red tape" is considerably less for attracting and servicing private-pay patients than it is for public patients. Therefore, private-pay patients are greatly preferred by nursing home providers, especially by the for-profit homes. In this setting, incentives to compete for private-pay patients clearly exists for both rural and urban homes.

As Ullman documents, unlike the hospital sector, the long-term health care sector has become increasingly influenced by for-profit facilities. Still, government regulations are ever present, affecting services delivered by both for-profit and nonprofit facilities. Morford explicitly delineates two extensive sets of Federal regulatory requirements and a variety of resultant and independent State regulatory requirements. Pertinent features of the competitive-regulatory environment must be considered when analyzing rural-urban differences in the services provided by the industry.

Government policies, as always, affect the level and quality of nursing home services. Policies at both the federal and state levels are becoming more complex. Approximately 70 percent of total patient days in South Carolina currently are funded by third-party providers; and over 85 percent of this funding is provided through the Medicaid program. Hence, as Scanlon and Wiessert (p. 387) concluded in 1983--"...for much of the industry, the market is a monopsony: Medicaid." With this much market power, the government can substantially affect providers' decisions on the selection and quality of services and the level of efficiency. If the Medicaid reimbursement rate is held constant when there are significant relative increases in prices of productive factors (e.g., wage rates of registered nurses), nursing services and other labor-intensive components of care are almost certain to be lowered. In contrast, if the reimbursement rate is quickly adjusted to reflect increasing costs, competition among provider homes can work more effectively toward improving the level and/or quality of services. An extensive review of States' Medicaid reimbursement methods and rates was made by Swan, et al. in 1988. The South Carolina Health and Human Services Finance Commission (SHHSFC) issues a revised set of Medicaid rate setting reimbursement policies every six months.

A second major policy area that affects the delivery of nursing home services and the scale of operations, at least in South Carolina, is the licensing of homes and their health inspections by the Department of Health and Environmental Control (DHEC). DHEC requires at least one licensed registered or practical nurse (RN or LPN) for every 44 beds in a skilled nursing home. Accordingly, most nursing homes in South Carolina have 44 beds or multiples thereof. Licenses are assigned in proportion to the elderly population residing in a county. Hence, a number of rural counties have but one nursing home, each with close to 44 or 88 or 132 beds.

The addition (or removal) of a nursing home can have a substantial economic impact in a

rural area that has a relatively small economic base. All nursing homes, regardless of size, are relatively labor intensive operations. On average, each home resident requires the combined services of one employee. Details on labor requirements in nursing homes are shown in table 1, in which 1991 South Carolina data show the average numbers of full-time (F) and part-time (P) employees for the three smallest nursing home groups. Fifty-nine of the 93 homes operating in South Carolina in 1991 are accounted for by the three home size groups shown in table 1.

Costs of owning and operating nonprofit nursing homes have consistently been shown to be higher than comparable costs in for-profit homes (Ullman; Holahan and Cohen). This pattern was corroborated in South Carolina in an earlier phase of the overall study (Yu, et al.). The fundamental concern investigated and discussed in this paper pertains to differences in costs between rural and urban homes. Information on the cost structure of rural and urban homes becomes important as policymakers make decisions on how and where to allocate nursing homes between rural and urban areas.

Access and Quality

A key dimension of nursing home *access* by potential patients is the geographic distribution of homes. Table 2 compares the geographic frequency distribution of the number of homes in rural and urban South Carolina counties for four recent years. Over half of the rural counties had only one or no homes. Seventy-five percent had two or fewer homes. In contrast, at the 50 percent frequency level, the urban counties had at least four homes; at the 75 percent level, they had at least six homes. Table 3 and Figure 1 illustrate geographic patterns similar to those shown in table 2. Rural homes draw considerably lower proportions of their patients from local or adjacent counties. These data clearly indicate that many rural people may have had less geographic *access* to nursing homes.

Less geographic *access* to nursing homes by the rural populace of South Carolina is not compounded, however, by relatively large numbers of older people. This is illustrated by the top two lines of the 1991 data in table 4. Proportions of rural and urban people over age 60 (and over 70) are not statistically different. Moreover, as illustrated by the lower two lines of table 4, there is no statistically significant difference in the proportions of older rural and urban people residing in nursing homes.

The current government policy goal (administered by DHEC in South Carolina) is to allocate identical shares of nursing beds to rural and urban areas. This goal appears to have been realized, judging from the 1986-1992 data shown in table 5. Mean ratios of beds to people do not differ statistically for any of the four years.

Previous research results by a number of investigators have documented the complexities of measuring *quality* in a nursing home setting. Feldstein (pp. 511-43) summarizes previous studies and suggests, as others do, that the proportion of private-pay patient days in each home can serve as a reasonable proxy for general *quality*. Figure 2 shows the frequency distributions of private-pay patients in rural and urban South Carolina homes in 1991. (Comparable study results are available for 1988, 1989 and 1990). Urban based homes clearly have higher proportions of private-pay patients. Hence, on-average, it appears that urban homes offer higher quality health services.

Cost Structure

Nursing home owners have limited control over their revenues, since Medicaid patient reimbursement rates are set by the government (SHHSFC in South Carolina). These predetermined rates are identical for rural and urban homes. Owners, however, do have considerable latitude over their net revenues as they can employ a number of cost control measures.

Home owners, thus, are hypothesized to minimize cost:

$$C = \sum_{j=1}^{n} P_j X_j \qquad (1)$$

subject to

Table 1. Average Number of Employees in South Carolina Nursing Homes by Size and Employment Category, 1991

Employment Category[a]	40-44 Beds	84-88 Beds	128-132 Beds
Administration F	1.00	1.17	1.38
Administration P	0.22	0	0
Physician F	0	0.03	0
Physician P	0.11	0	0
Nurse F	4.67	11.69	18.48
Nurse P	3.67	6.14	10.29
Nursing Aides F	11.56	30.83	48.57
Nursing Aides P	3.89	8.40	13.14
Records Keeper F	0.22	0.48	0.95
Records Keeper P	0.33	0.24	0.048
Pharmacist F	0	0	0.10
Pharmacist P	0	0	0
Dietician F	0	0.03	0.24
Dietician P	0	0	0.10
Dietetic Technician F	1.22	0.97	1.10
Dietetic Technician P	0	0	0.10
Therapist F	2.00	3.21	4.43
Therapist P	0.33	0.76	0.57
Others F	6.56	19.00	37.43
Others P	1.44	4.69	6.76
Total F	27.22	67.38	112.67
Total P	10.00	20.24	31.00
Skilled F	7.67	16.14	24.62
Skilled P	4.33	6.93	10.95
Nonskilled F	19.33	50.79	87.10
Nonskilled P	5.33	13.07	20.00

[a]Full-time employees are denoted as F; part-time by P. Skilled employees include administrators, nurses, physicians, pharmacists, dieticians, and therapists. There are nine homes in the group of 40-44 beds, 29 homes in 84-88 beds group, and 21 homes in 128-132 beds group--accounting for 59 of the 93 homes operating in South Carolina in 1991.

Table 2. Distribution of Number of Nursing Homes in Rural and Urban Counties

Cumulative Percentage Distribution	Rural Counties[a]				Urban Counties[a]			
	1986	1988	1990	1992	1986	1988	1990	1992
	(Number of Homes)							
Min.	0	0	1	0	2	2	2	1
10	0	1	1	1	2	3	2	3
25	1	1	1	1	4	4	4	3
50	1	1	1	1	4	4	5	6
75	2	2	2	2	6	6	7	8
90	3	4	3	3	9	11	10	13
Max.	11	11	12	7	14	11	13	13

[a]Total number of rural counties = 31, total number of urban counties = 15.

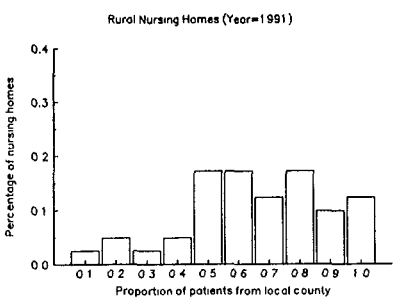
Table 3. Distribution of Nursing Home Patients' Original Resident Locations and their Nursing Home Locations for Rural and Urban Areas, 1988 to 1991

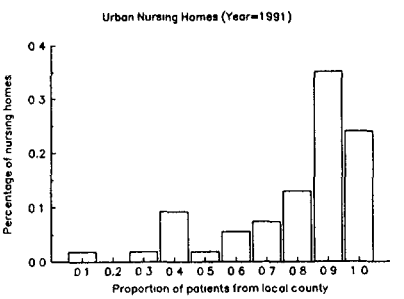
	1988	1989	1990	1991
		(Number)		
Total patients from rural areas	3730	3984	3669	4152
Total patients from urban areas	5497	5147	6018	5590
		(Percent)		
Rural patients from out counties[a]	37.3	50.0	39.4	37.7
Urban patients from out counties	22.0	21.2	20.2	22.4
Rural patients from remote area[b]	11.4	27.6	11.4	11.5
Urban patients from remote area	7.6	6 5	6.2	8.9

[a] Out counties are defined as any counties other than the county where the nursing home is located.

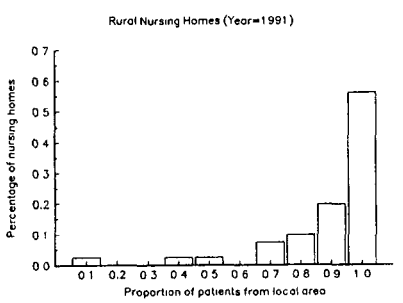
[b] Remote area is defined as any county other than the county where the nursing home is located or a county adjacent to this county location.

Figure 1. Distribution of Nursing Homes with Respect to Proportion of Local Patients from Local Counties





from Local and Adjacent Counties



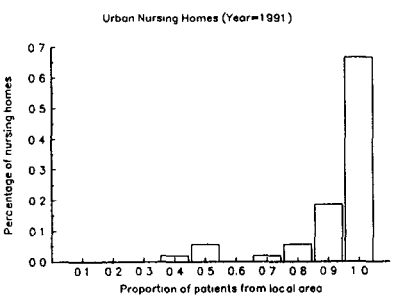


Table 4. Properties of Aged Population and Nursing Home Patients in Rural and Urban Counties in 1991

Age Classification	Rural		Urban	
	Mean	Std. Dev.[a]	Mean	Std. Dev.[a]
Proportion of population over 60	0.170	0.023	0.157	0.022
Proportion of population over 70	0.083	0.013	0.073	0.012
Proportion of nursing home patients in the population over 60	0.017	0.009	0.018	0.0008
Proportion of nursing home patients in the population over 70	0.034	0.019	0.039	0.017

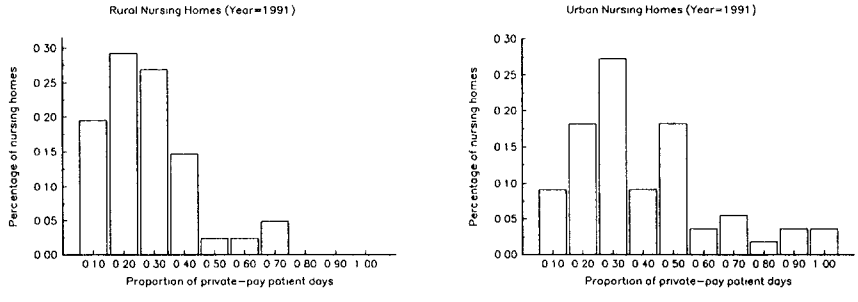
[a] Standard deviation of the mean.

Table 5. Ratios of Nursing Home Beds to Total Population Over 60, Rural and Urban Counties

Year	Rural Counties		Urban Counties	
	Mean	Std. Dev.[a]	Mean	Std. Dev.[a]
1986	0.0212	0.0154	0.0229	0.0084
1988	0.0226	0.0148	0.0251	0.0088
1990	0.0259	0.0145	0.0261	0.0091
1992	0.0268	0.0149	0.0255	0.0075

[a] Standard deviations of means; 31 rural counties, 15 urban counties.

Figure 2. Distribution of Nursing Homes with Respect to Private-Pay Patient Days



$$h(x_1,...,x_n,\ N_{SNF}\ ,\ N_{ICF}\ ,\ e^{Q}) = 0, \tag{2}$$

where C equals total cost or total operating cost, X_j denotes input services, P_j denotes input prices, N_{SNF} equals the number of skilled nursing facility patient days, N_{ICF} equals the number of intermediate care facility patient days, and Q is an index reflecting the quality of services.

To accommodate prior restrictions and maintain flexibility, a translog function is employed to model costs. This function is specified as[3]

$$\begin{aligned} LnC = {} & \alpha_0 + \alpha_1 LnN_{SNF} + \alpha_2 LnN_{ICF} + \alpha_3 Q + \sum_{j=1}^{n} \delta_j LnP_j \\ & + \frac{1}{2}\beta_1 (LnN_{SNF})^2 + \frac{1}{2}\beta_2 (LnN_{ICF})^2 + \frac{1}{2}\beta_3 Q^2 \\ & + \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{n} \beta_{ij} LnP_i LnP_j + \frac{1}{2}\sum_{j=1}^{n} \gamma_{j1} LnN_{SNF} LnP_j \\ & + \frac{1}{2}\sum_{j=1}^{n} \gamma_{j2} LnN_{ICF} LnP_j + \frac{1}{2}\sum_{j=1}^{n} \gamma_{j3} LnQLnP_j \\ & + \frac{1}{2}\gamma_{12} LnN_{SNF} LnN_{ICF} + \frac{1}{2}\gamma_{31} QLnN_{SNF} + \frac{1}{2}\gamma_{32} QLnN_{ICF}. \end{aligned} \tag{3}$$

Using Shephard's Lemma, the cost share for each input (S_j) can be obtained as

$$\begin{aligned} \frac{\partial LnC}{\partial LnP_j} = \frac{P_j X_j}{C} = S_j = {} & \delta_j + \frac{1}{2}\sum_{i=1}^{n} \theta_{ij} LnP_i \\ & + \frac{1}{2}\gamma_{j1} LnN_{SNF} + \frac{1}{2}\gamma_{j2} LnN_{ICF} + \frac{1}{2}\gamma_{j3} Q, \end{aligned} \tag{4}$$

where $j = 1, 2, ..., n$, and n is the total number of input factors and $\theta_{ij} = \beta_{ij} + \beta_{ji}$.

Assuming that the prices of input factors are the same within urban and rural areas, each factor price P_j has only one of two alternative values: rural or urban. Let $P_j = (P_{rj} + \Delta P_j)$, where P_{rj} is the rural price for factor j and ΔP_j is the difference between rural and urban prices for factor j; P_{rj} will be constant for all the observations and ΔP_j will be zero for rural homes. Therefore, P_{rj} can be merged with the intercept δ_j and ΔP_j can be reflected by the dummy variable R_j. All factor prices can be decomposed in this way, and the dummy variables R_j (j = 1,2,..., n) are the same. Therefore, the summation (Σ) term in expression (4) can be combined into one intercept shifting dummy variable (R) to reflect input price differences between rural and urban areas.

Another covariate which likely affects cost shares is the home ownership (W) status. Managers in nonprofit homes do not have incentives to maximize profit, but they still can be assumed to seek to minimize costs because their resources are limited (Ullman). Of course, managers in nonprofit homes may have different goals to achieve in seeking to minimize costs; as a result, the cost share function may differ between for-profit and nonprofit homes.

Accounting for input price differences by a rural-urban dummy variable (R) and adding a second intercept shifting dummy variable (W) to distinguish between nonprofit and for-profit ownership, cost shares (S_j) can be expressed as

$$\begin{aligned} S_j = {} & \delta_j + \frac{1}{2}\gamma_{j1} LnN_{SNF} + \frac{1}{2}\gamma_{j2} LnN_{ICF} \\ & + \frac{1}{2}\gamma_{j3}\ Q + \delta_{1j}\ W + \delta_{2j}\ R. \end{aligned} \tag{5}$$

For simplicity of expression, equation (5) is written as

$$\begin{aligned} S_j = {} & a_j + b_{1j}\ LnN_{SNF} + b_{2j}\ LnN_{ICF} \\ & + b_{3j} Q + a_{2j}\ W + a_{3j}\ R \end{aligned} \tag{6}$$

where

$$b_{1j} = \frac{1}{2}\gamma_{j1}\ ,\ b_{2j} = \frac{1}{2}\gamma_{j2}\ ,\ b_{3j} = \frac{1}{2}\gamma_{j3}\ ,\ a_{2j} = \delta_{1j}\ ,\ \ a_{3j} = \delta_{2j}$$

from equation (5), and all other notation was heretofore defined in equations (1) through (5).

The index of nursing care Q is measured by a linear combination of registered nursing and nursing aide hours, as follows:

$$Q = \frac{1}{2}(I_{nur} + I_{aide})\ , \tag{7}$$

where

$$I_{nur} = \frac{N_{nur}}{3\ K\ N^0_{nur}}, \qquad I_{aide} = \frac{N_{aide}}{3\ K\ N^0_{aide}},$$

and

$$N_{nur} = \frac{N_{beds}}{N_{fnur} + 2N_{pnur}}, \qquad N_{aide} = \frac{N_{beds}}{N_{faide} + 2N_{paide}},$$

and

N_{beds} = number of licensed beds,

N_{fnur} = number of full time licensed nurses hired,

N_{pnur} = number of part time licensed nurses hired,

N_{faide} = number of full time aides hired,

N_{paide} = number of part time aides hired,

N^0_{nur} = number of beds per nurse per shift required by DHEC,

N^0_{aide} = average number of beds per aide per shift required by DHEC,

K = a factor reflects the proportion of *SNF* patient days, which is determined as follows:

> If the proportion of *SNF* patient days is greater than or equal to 0 but less than 0.1, $k = 0.1$ and if the proportion of *SNF* patient days are greater than or equal to 0.1 but less than 0.2, $k = 0.2$, ..., if the proportion of *SNF* days are greater or equal to 0.9, $k = 1$.

Since the number of nurses and nursing aides is positively related to proportion of skilled patient days, the parameter K is used to adjust for different proportion of skilled patient days. The constant number, 3, in the denominator is accounted for by three shifts per day. In a nursing home, nurses are in charge of the services, but nursing aides are directly serving the patients. Hence, an equal weight is put on nurses and nursing aides for the quality index. The index Q reflects the ratio of actual number of nurses and nursing aides hired in each home in light of the number required by the state government (DHEC).

The central question to be answered by the cost share model (6) is: do the relative input prices and/or production functions differ between rural and urban nursing homes? If the answer is yes, the share of cost with respect to the input factors that have been affected by reimbursement policies will be different between rural and urban homes. Facing the same reimbursement rate, owners/managers of rural homes will be expected to reduce the employment of adjustable input factors, *if* the share of cost due to the controllable inputs for rural homes is higher than for urban homes. (The converse can be concluded for owners of urban homes.) As a result, services provided by rural homes would differ significantly from urban homes *if* different proportions or different qualities of factors are employed in the production of the home services set.

This question cannot effectively be addressed by observing only total operating costs (or total costs) and employing either of these variables as the dependent variable in an OLS model. Alternative versions of this approach were tried in previous studies (Yu, et al.). A total operating cost model cannot account for different levels of input factor prices, which likely are different across rural and urban areas. Accordingly, this article concentrates on several input shares and their primary determinants. Total operating cost is divided into five major categories: nursing care, dietary, administration, maintenance and utilities. Each category's cost share is calculated as a percentage of total operating costs, and can be statistically estimated using the multi-output translog cost model--(5) or (6), above. Nursing home output, represented by patient days of skilled nursing and intermediate care, is adjusted for specific qualities of nursing care, for the home ownership base ("nonprofit" and "for-profit"), and for rural versus urban locations.

Measurement of nursing home output using the variables *SNF* and *ICF* is not ideal, but can be defended as acceptable on theoretical grounds (McKay). In order to minimize costs, home operators are hypothesized to combine resources in a manner that will maintain the average cost of

patient services at a level commensurate to the mix of output prices. The total number of patient days, without accounting for service intensity, is regarded as an oversimplified measure of output. Medicaid reimbursement levels definitely are keyed to the proportion of *SNF* patients (SHHSFC). Some researchers have attempted to characterize a detailed functional status for patients (e.g., Schlenker and Shaughnessy, Schneider et al.), but with limited success. Data on *SNF* and *ICF* levels are readily available, relatively accurate and amenable to policy implications.

A seemingly unrelated multivariate regression model (*SURM*) could be employed to estimate model parameters for each of the five cost categories (Zellner). However, since the explanatory (*RHS*) variable are identical for each equation, *OLS* will result in equivalent estimates. Therefore, each of the five cost share models, (6), was fitted by the method of *OLS* to estimate its parameter values. Either *OLS* or the equivalent *SURM* handles correlation, if any, across disturbance terms in the individual equations, assuming that the disturbances are conveniently represented by a joint normal distribution.

We used data from four years, 1988 through 1991, to estimate the relationship between the shares of each cost category and the set of explanatory variables. In order to reflect structural changes over time, we used three sets of dummy variables to capture any change in intercepts and slopes for all of the conventional *RHS* variables. (We also conducted regressions on a yearly basis. The estimated coefficients in 1988 were the same for all the coefficients estimated in the pooled model, since 1988 was used as the base year.) The data were obtained from actual cost reports to the SHHSFC for reimbursement. After excluding hospital-based nursing homes, the number of observations was 95 in 1988, 89 in 1989, 94 in 1990, and 95 in 1991. Therefore, the pooled sample had 373 observations. Table 6 presents the estimated coefficients and other regression results.

The top block of table 6 reflects the relationship between the base year (1988) and the explanatory variables. Regression results show several significant relationships between the set of explanatory variables and the shares of each cost category. First the *SNF*-patient-days variable is positively related to the share of nursing costs and negatively related to the shares of dietary and maintenance costs. A reasonable explanation for these relationships is that skilled patients require more nursing hours relative to total operating costs. However, more skilled patients do not increase dietary and maintenance costs. Second and third, the *ICF*-patient-day variable is negatively related (at the 10 percent significance level) to the share of administration cost and positively related to maintenance costs. *ICF* patients require less paper work, which may reduce administration costs. Why the *ICF*-patient day is positively related to the share of maintenance cost is not clear. The quality index in this model actually represents nursing hours. It is not surprising that the quality index is positively related to the share of nursing cost. It, however, is negatively related to the shares of dietary and maintenance costs, implying that the services of dietary and maintenance (including maintenance, housekeeping, and laundry) are not generally proportional to the intensity of nursing services. This result also may reflect the trade-off between the number of nursing aides and the number of employees in housekeeping, maintenance, and laundry. Fourth, privately owned for-profit homes save some money in utility and maintenance costs. Finally, and most importantly, there is no difference between urban and rural homes in the shares of all cost categories, except for utility costs.

The remaining three blocks in table 6 reveal any structural changes in the cost function over time (1989 through 1991). The results do not show any change in the rural-urban share difference from 1988 through 1991. In general, there is no structural change in any of the explanatory variables over the four years. Compared with the coefficients in 1988, the dummy variables in 1990 indicate that the share of nursing cost goes up per *ICF*-patient day and goes down for each unit of quality index (both significant at the five percent level). Another change in 1990 is the relationship between the quality index (Q) and the dietary cost.

A few structural changes in the cost function did occur in 1991. The intercept term of the share of dietary cost increased more than 60 percent--highly significant statistically. On the other hand, for the share of dietary cost the 1991

Table 6. Estimated Coefficients of the Variables in the Translog Cost Function for Shares of Operating Cost Categories: Pooled Model with Fixed Effects in Intercepts and Slopes

Variable	Snurse	Sadmin	Sdiet	Sutil	Smaint
Intercept	0.3917[a]	0.1815[a]	0.1913[a]	0.0598[a]	0.1757[a]
SNF-day	0.0130[a]	-.0019	-.0061[a]	-.0012	-.0039[c]
ICF-day	-.0022	-.0047[c]	0.0034[c]	0.0001	0.0034[c]
Quality	0.0072[b]	0.0003	-.0029[c]	-.0005	-.0041[b]
Ownership	0.0122	0.0011	0.0061	-.0063[b]	-.0131[c]
Urban	0.0011	0.0023	-.0022	0.0052[a]	-.0065
Y89	-.0047	-.0154	0.0262	-.0067	-.0089
Y89*SNF-day	-.0013	0.0009	-.0019	0.0009	0.0013
Y89*ICF-day	0.0055	-.0006	-.0013	-.0009	-.0028
Y89*Quality	-.0025	0.0014	-.0012	0.0008	0.0016
Y89*Ownership	-.0078	0.0056	0.0018	0.0017	-.0013
Y89*Urban	-.0071	-.0019	0.0047	-.0016	0.0060
Y90	-.0009	0.0169	-.0088	0.0008	-.0099
Y90*SNF-day	-.0048	0.0020	0.0010	0.0008	0.0011
Y90*ICF-day	0.0100[b]	-.0033	-.0026	-.0013	-.0028
Y90*Quality	-.0078[b]	0.0009	0.0036[c]	0.0002	0.0031
Y90*Ownership	-.0013	-.0022	0.0093	0.0010	-.0068
Y90*Urban	0.0029	-.0020	-.0016	-.0027	0.0035
Y91	-.1617	0.0444	0.1358[a]	-.0048	-.0136
Y91*SNF-day	0.0158[c]	0.0079	-.0189[a]	0.0026	-.0074
Y91*ICF-day	0.0043	-.0111[c]	0.0039	-.0030	0.0058
Y91*Quality	-.0033	0.0005	-.0004	0.0008	0.0023
Y91*Ownership	0.0137	-.0160	0.0060	0.0005	-.0041
Y91*Urban	-.0103	-.0014	0.0044	-.0030	0.0102
R^2	0.3346	0.1168	0.3918	0.1536	0.2073

[a]Significant at 0.01 level; [b]Significant at 0.05 level; [c]Significant at 0.10 level.
Y89, Y90, Y91 = Dummy variables for 1989, 1990, and 1991, respectively.
Total number of observations = 373.
Snurse = Share of nursing cost,
Sadmin = Share of administration cost,
Sdiet = Share of dietary cost,
Sutil = Share of utility cost, and
Smaint = Share of maintenance cost.

coefficient of the *SNF*-patient day is reduced about three times in value, significant at the one-percent level. Other changes in 1991 include a decrease in the coefficient of *ICF*-patient days with respect to the share of administration cost and an increase in the coefficient of *SNF*-patient days with respect to the share of nursing cost--both significant at the 10 percent level.

The regression analyses also included tests for heteroscedasticity (by the method of White) for each of the five models. At the five percent type-I error level, no heteroscedasticity was detected for any of the five equations. (Test statistics for these tests are available upon request.) In this light, the relatively low R^2 values are not regarded as a major problem since the data are cross sectional. Since the policy variables of interest are included, the low R^2 values simply indicate a large degree of random variation.

Summary and Conclusions

Demand in the U.S. for nursing home care, rural and urban, is increasing steadily, and is likely to greatly accelerate, especially by year 2011 when the "boomers" begin getting old (age 65). Much of the care is likely to be financed through public programs. Already, around 60 percent of all financing is non-private. Public scrutiny and control is likely to continue to expand through the federal and state governments.

Rural area long-term nursing care services, and their financing, have not been separately studied to date. This paper examines the accessibility, quality and cost structure of long-term care services from a supply-of-services perspective, focusing on comparisons of South Carolina's rural and urban areas. Rural-urban differences in these services are

quantified and tested for several years, especially for 1988 through 1991.

Nursing homes are a relatively labor intensive industry, in rural areas and in urban areas. South Carolina data for 1991 reveal that, on-average, each nursing home resident requires the services of one employee; over 70 percent of these are nonskilled. This has fairly obvious financial and economic implications for future policies on licensing and reimbursement. An intuitive framework for the supply of nursing home services conceptualizes that they are codetermined by competitive and regulatory forces, government policies, and by the cost structure of homes. Rural-urban differences in the supply of services (i.e., their accessibility and quality subject to costs) are examined in the context of this conceptual framework.

A descriptive analysis of secondary data indicates that there are relatively few "closely-located" homes available for entry and use by South Carolina's rural residents, but that these rural-urban differences are not very pronounced. A preliminary quantitative analysis, based primarily on descriptive statistics about nursing home and nursing care services available to private-pay patients, indicates that urban residents have had some more access to more homes which are generally considered to offer higher quality services.

A linear model for explaining and testing the significance of rural-urban differences in cost shares is derived by starting with a constrained cost optimization model, developed into a translog cost function, and then into the cost share model of this study by employing Shephard's Lemma. This model hypothesizes that cost shares (S) for nursing home inputs are a function of the geographic area (rural or urban) and the following covariates: the degree of skilled nursing (*SNF* level) in a home, a quality-of-home index (Q), and the ownership status (nonprofit or for-profit) of a home (W).

Model parameters were estimated using 1988-1991 data for five major cost categories (nursing, dietary, administration, maintenance, and utilities). Since the *RHS* variables are identical for the five categories, the *OLS* estimates are identical to those obtained using a seemingly unrelated regression model (*SURM*). In this research, we used the General Linear Model procedure (*GLM*) to examine more information for the system of equations.

Cost share regressions reveal the following: (a) no significant differences in the operating cost structure of rural versus urban homes, except the utility cost, over the four-year period. This is a major finding of this study--one with several policy implications; (b) A direct relation between the nursing cost share and *SNF* levels, remarkably consistent across the four years; (c) A negative relationship between the nursing care quality and the dietary and maintenance cost shares, suggesting either that the dietary and maintenance services are not proportional to the intensity of nursing care, or that there is a trade-off between nursing aides and employees in the other two groups; and (d) Cost shares, especially for maintenance and utilities, which tend to be higher in the nonprofit homes, consistent with the findings from earlier studies that per-diem total operating cost run around $5 lower in the for-profit homes. The higher total cost for nonprofit homes does not necessarily mean they are less efficiently operated; much of this difference might be due to higher quality, thus more expensive, home facilities.

Even though the fitted regression equations had relatively low R^2 values, White tests did not detect any heteroscedasticity. Thus, the model which was developed, with its *RHS* variables, could be confidently employed to draw valid, meaningful policy implications.

While there is no significant difference in the number of elderly per bed between rural and urban areas, the number of nursing homes differs significantly. This suggests that the elderly in the rural areas of South Carolina do not have the same level of accessibility to nursing homes as those in urban areas. The cost structure analysis in this research indicates no significant difference between rural and urban homes. An earlier study (Yu, et al.)[4] found only trivial scale economies in administration and dietary costs (only a one cent reduction for each additional bed). The policy implication from this study is that encouraging small rural nursing homes may not substantially elevate operating costs. And, more small rural

homes could improve nursing home accessibility for the rural population and may also improve the rural economy.

The findings of this study may not apply directly to states where the urban areas are much more urban (having much higher relative population densities) compared to the surrounding rural areas, e.g., in Minnesota or New York. South Carolina's rural and urban areas, however, are similar to many other states, including Mississippi, Alabama, Arkansas, Tennessee, Kentucky and Virginia. The research methodology, especially the development and use of the cost-share model, could prove useful to the study of extended care departments of rural and urban hospitals, to the study of board-and-care homes, and as an integral part of a more comprehensive study of the entire set of health services supplied by rural and urban-based providers.

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Endnotes

1. Day and Klein compared the regulation and operations of nursing homes in the United States to those in Britain; they did not consider any rural-urban differences.

2. Essentially, rural areas are defined to begin where the population density drops below 50 people per square kilometer, relative to the center of an urban area. Accordingly, by this definition, each urban area will be a circle and some counties will be partly rural and partly urban. For practical purposes, however, counties are designated as rural if/when over 50 percent of the county's geographic area had a population density lower than 50. The validity of this classification method can be defended, and it can be argued that it has more substance than classifications based solely on census data (Henry, et al.). By this definition, 15 of the 46 counties in South Carolina were designated as urban in five geographic areas: (1) five counties around the cities of Greenville, Spartanburg and Anderson, (2) two counties in the Charlotte (North Carolina) area, (3) three counties in the Florence-Myrtle Beach area, (4) three counties in and around Charleston, and (5) two counties in the Columbia-Augusta (Georgia) area.

3. A translog function is actually a second order approximation of Taylor's expansion. Therefore, it is less restrictive than most linear functions.

4. Yu, et al. analyzed South Carolina nursing homes for economies of scale. The number of beds had a significant impact only on administration and dietary costs, and the per diem total operating cost is lowered only about one cent for each bed increased. On the other hand, the Department of Health and Environment Control in South Carolina requires that one licensed nurse has to be hired for every 44 beds. This implies

that the most likely size is no less than 44 beds. Hence, adjustments in the reimbursement and staff requirement policies are needed in order to increase the number of small rural nursing homes.